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**Panel on Transport**

**Subcommittee on Matters Relating to Railways**  
**Meeting on 5 June 2020**

**Updated background brief on upgrading signaling system**  
**for railway lines**

**Purpose**

This paper provides updated background information on the upgrade of signalling system for railway lines. It also summarizes the major views and concerns expressed by members of the Subcommittee on Matters Relating to Railways ("the Subcommittee") during previous discussion on the subject.

**Background**

2. The MTR Corporation Limited ("MTRCL") has been monitoring the capacity of railway lines under the existing signalling system. To increase capacity and further enhance the overall reliability and efficiency of railway services, MTRCL earlier decided to replace the signalling systems of seven MTR lines (Tsuen Wan Line, Island Line, Kwun Tong Line, Tseung Kwan O Line, Disneyland Resort Line, Tung Chung Line and Airport Express). According to the information provided by MTRCL in January 2019, works of the replacement projects will be completed in phases to mitigate the potential risks during the works, and the timeframe of completion is at **Appendix I**. Upon the completion of the upgrade of signalling systems in 2026, the overall capacity of the seven MTR lines can be increased by about 10%. MTRCL is also replacing the signalling system of the East Rail Line to tie in with the operations of the Shatin to Central Link.

3. According to MTRCL, any large-scale system upgrade would entail the risks that the system may become unstable during the process with higher risks of service disruption. Such risks are common to any system change.

Overseas experiences indicate that some railways try to avoid such risks by partially or fully suspending railway services when their signalling systems undergo major upgrades until the completion of works. However, this arrangement is not practicable in Hong Kong having regard to Hong Kong's well-developed public transport system. Therefore, MTRCL has to maintain its service level during upgrades of its signalling systems to avoid causing inconvenience to passengers. It is crucial to complete a smooth upgrade of the signalling system while minimizing the risks of impacting on railway service.

4. Replacement of signalling system involves the installation of a large number of new equipment such as optical fibres, cables, equipment at trackside and stations, followed by extensive tests to be rolled out in a progressive manner to achieve safe and smooth operations before the new system comes into service. Tests include switching from the existing signalling system to the new system on test-tracks at depots and on main lines. To minimize impact on train services, on-site tests on main lines are conducted during non-traffic hours overnight and there are only about two hours available each night for the tests. The Electrical and Mechanical Services Department ("EMSD") will inspect the tests on-site and the new system could only come into operations after obtaining the approval by EMSD.

5. According to the MTRCL, it has conducted a comprehensive risk assessment for the signalling upgrading project, including strengthening the manpower for monitoring system stability during switches between the existing and new systems. MTRCL has formulated contingency measures on the basis of the existing contingency mechanism for railway service delays. MTRCL has arranged technical personnel and shuttle buses to stand by and manpower to provide assistance to passengers where appropriate and necessary. The contingency plans formulated by MTRCL in case of disruption of railway services has been agreed with various Government departments including the Police and the Transport Department.

### **Members' major views and concerns**

6. At the Subcommittee meeting on 1 February 2019, members were deeply concerned that the expected completion of the upgrading of the new signalling systems for Tsuen Wan Line and Island Line would be completed by 2019 and 2021, representing a delay by one year and two years respectively. A member worried that the congestion situation of railway lines would be aggravated as a result of the delay in the signalling system upgrading programme.

7. MTRCL explained that the time required for conducting tests was longer than estimated, mainly because MTRCL had been carrying out in-depth testing on the new signalling system, and making reference to experience in other places, in order to ensure a higher level of reliability before commissioning. The tests conducted during non-traffic hours covered accuracy of trains' stopping locations, coordination between train doors' opening and closing and platform screen doors, and passenger comfort level. The Administration also noted member's concern about the carrying capacity of railway lines and would consider as appropriate the suggestions of implementing flexible working hours and offering more early bird discount to passengers with a view to alleviating the crowded situation on MTR trains during peak hours.

8. The Subcommittee was also gravely concerned about the incident on 18 March 2019, in which two MTR trains collided near Central Station on Tsuen Wan Line in the early hours during the testing of the new signalling system. Members received a briefing from the Administration and MTRCL on the incident at its meeting on 29 March 2019. Some members considered that MTRCL failed to properly supervise its contractor to carry out the simulation tests of the new signalling system. Pointing out that signalling systems were generally operated on main and stand-by sector computers, members enquired about the reasons for providing a back-up computer in the new signalling system.

9. MTRCL advised that to enhance the reliability and availability of the new signalling system, MTRCL had specified in the contract between MTRCL and the signalling system contractor that a back-up sector computer should be provided. As stated in the system specifications of the contract, the main, stand-by and back-up sector computers were identical in terms of functions and safety requirements. MTRCL emphasized that the contractor had the responsibility to ensure the safety of the new signalling system, including the provision of a safe and reliable signalling system for testing.

10. Members raised concern about the safety and reliability of the new signalling system, and asked whether and how MTRCL would ensure that incident of similar nature would not occur again in the future.

11. MTRCL advised that as a matter of prudence, it had immediately suspended all the train tests pertinent to the signalling system upgrade programme and conducted in-depth investigation of the incident. MTRCL and EMSD had completed the investigations on the incident in June and July 2019 respectively. EMSD accepted the investigation outcome of the Investigation Panel set up by MTRCL on the cause of the incident, which was the programming error in the software of the new signalling system as a result of multiple implementation errors of the contractor. Details of the

respective investigation results and follow-up measures recommended by MTRCL's Investigation Panel and EMSD were set out in the Administration's information paper on the incident of the new signalling system testing on Tsuen Wan Line on 18 March 2019 [LC Paper No. CB(4)1097/18-19(01)].

12. Members were very concerned about the safety of the existing signalling system and asked whether similar incidents would occur on the existing lines. The Administration responded that to ensure the safety of the existing signalling system, EMSD had conducted on-site inspection on the safety-critical components of the existing signalling system, including the inter-locking functions of the computer-controlled turnouts. The results showed that the existing system continued to operate smoothly. According to MTRCL, the hardware and software of the new signalling system under testing were different from that of the existing signalling system. They were two separate systems. At the time of the incident, scenario testings of the new signalling system were being conducted on Tsuen Wan Line and the existing signalling system was completely segregated. All signalling trackside and trainborne equipment were controlled by the new system at the material time. Hence, MTRCL's Investigation Panel concluded that the incident was not related to the existing signalling system, and incidents of similar nature would not occur to the existing operations.

13. In response to some Members' concern that whether the service disruption of four MTR lines on 16 October 2018 was related to the signalling system upgrading project, the Administration advised that based on the signalling system data records of MTRCL, the incident indeed occurred only after MTRCL had switched the signalling system back to the existing one and had operated normally for some time. Hence, there was no evidence showing correlation between the incident and signalling system upgrading project and its testing.<sup>1</sup>

14. When discussing the above incident at the Subcommittee meeting on 29 October 2018, a member was concerned about the ageing problem of the existing signalling system and the target completion of the signalling upgrading project. MTRCL advised that it would take reference from this experience to avoid recurrence of similar incidents from happening in the new signalling system. The replacement of signalling systems was expected to complete in 2026.

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<sup>1</sup> MTRCL submitted a report to the Government on 19 December 2018 on its investigation on the incident. The report confirmed that the incident had no correlation with the signalling system upgrading project and its testing. For details, please refer to the [press release](#) issued by the Transport and Housing Bureau on 19 December 2018.

15. Noting that the corrosion of a copper data-link was the cause of train service disruption of Kwun Tong Line on 5 August 2017, some members were dissatisfied that such problem had not been discovered during regular maintenance. They also urged MTRCL to make timely investment to renew its railway assets including the signalling systems, with a view to keeping abreast of the technological advancement and enhancing the reliability and safety of the railway system. MTRCL advised that the problem had not been encountered before and that it would take into account the lessons learnt from the incident and to enhance the maintenance of parts and components of the signalling system having regard to weather conditions.

16. On some members' concerns regarding the life expectancy of the new signalling system, and whether the electronic components of the signalling system would be updated regularly within its overall system life-cycle to keep pace with technological advancements, MTRCL advised that normally a signalling system should have 20 to 30 years' lifetime. It had requested its service contractors to provide adequate technical support to regularly update the parts and software of the signalling system within its overall system life-cycle. In addition, a stringent asset management system was in place to set out appropriate procedures for the maintenance of various components of the railway system, including signalling system equipment. Timely renewal would be arranged in accordance with the functions and performance of the railway components.

### **Latest development**

17. The Administration plans to update the Subcommittee on the progress of upgrading the signalling systems for railway lines at the meeting to be held on 5 June 2020.

### **Relevant papers**

18. A list of relevant papers is in **Appendix II**.

**Timeframe of Expected Completion of New Signalling Systems**

<b>Railway Line</b>	<b>Expected Completion</b>
Tsuen Wan Line	2019
East Rail Line	2019
Kwun Tong Line	2020
Island Line	2021
Tseung Kwan O Line	2021
Tung Chung Line, Disneyland Resort Line and Airport Express	2026

Source: LC Paper No. CB(4)468/18-19(05)

## Upgrading signalling system for railway lines

### List of relevant papers

Date of meeting	Meeting	Minutes/Paper	LC Paper No.
1 December 2017	Subcommittee on Matters Relating to Railways	Administration's paper on progress on upgrading signalling system for railway lines	CB(4)260/17-18(03)  <a href="https://www.legco.gov.hk/yr17-18/english/panels/tp/tp_rdp/papers/tp_rdp20171201cb4-260-3-e.pdf">https://www.legco.gov.hk/yr17-18/english/panels/tp/tp_rdp/papers/tp_rdp20171201cb4-260-3-e.pdf</a>
		Minutes of meeting	CB(4)355/18-19  <a href="https://www.legco.gov.hk/yr17-18/english/panels/tp/tp_rdp/minutes/rdp20171201.pdf">https://www.legco.gov.hk/yr17-18/english/panels/tp/tp_rdp/minutes/rdp20171201.pdf</a>
2 February 2018	Subcommittee on Matters Relating to Railways	Administration's response to the joint letter from Dr Hon KWOK Ka-ki, Hon Jeremy TAM Man-ho, Hon Tanya CHAN and Hon Alvin YEUNG and the letter from Hon LAM Cheuk-ting on the signalling fault of the East Rail Line on 11 January 2018	CB(4)554/17-18(01)  <a href="https://www.legco.gov.hk/yr17-18/chinese/panels/tp/tp_rdp/papers/tp_rdp20180202cb4-554-1-c.pdf">https://www.legco.gov.hk/yr17-18/chinese/panels/tp/tp_rdp/papers/tp_rdp20180202cb4-554-1-c.pdf</a> (English version to follow)
9 October 2018*	Subcommittee on Matters Relating to Railways	Letter dated 9 October 2018 from the Administration on "Progress of MTR Railway Services"	CB(4)1612/17-18(01)  <a href="https://www.legco.gov.hk/yr17-18/chinese/panels/tp/tp_rdp/papers/tp_rdp20181009cb4-1612-1-c.pdf">https://www.legco.gov.hk/yr17-18/chinese/panels/tp/tp_rdp/papers/tp_rdp20181009cb4-1612-1-c.pdf</a> (English version to follow)

\*Issue date

Date of meeting	Meeting	Minutes/Paper	LC Paper No.
24 October 2018	Council meeting	Hon Gary FAN Kwok-wai raised a question on the urgent measures to prevent and deal with large-scale disruptions of railway services	<a href="https://www.info.gov.hk/gia/general/201810/24/P2018102400409.htm">https://www.info.gov.hk/gia/general/201810/24/P2018102400409.htm</a>
29 October 2018	Subcommittee on Matters Relating to Railways	Administration paper on service disruption of four MTR lines on 16 October 2018	CB(4)110/18-19(03) <a href="https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20181029cb4-110-3-e.pdf">https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20181029cb4-110-3-e.pdf</a>
		Administration's paper on "Services disruption of four MTR lines on 16 October 2018" (follow-up paper)	CB(4)74/19-20(01) <a href="https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20181029cb4-74-1-e.pdf">https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20181029cb4-74-1-e.pdf</a>
		Minutes of meeting	CB(4)1116/18-19 <a href="https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/minutes/rdp20181029.pdf">https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/minutes/rdp20181029.pdf</a>
7 December 2018	Subcommittee on Matters Relating to Railways	Administration's response to the letters from Hon Claudia MO and Hon LAM Cheuk-ting requesting to discuss service disruption of several MTR lines on 16 October 2018 due to signalling system faults as set out in LC Paper Nos. CB(4)73/18-19(01)-(02)	CB(4)149/18-19(01) <a href="https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20181207cb4-149-1-e.pdf">https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20181207cb4-149-1-e.pdf</a>

Date of meeting	Meeting	Minutes/Paper	LC Paper No.
1 February 2019	Subcommittee on Matters Relating to Railways	Administration's paper on progress on upgrading signalling system for railway lines	CB(4)468/18-19(05) <a href="https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20190201cb4-468-5-e.pdf">https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20190201cb4-468-5-e.pdf</a>
		Minutes of meeting	CB(4)1257/18-19 <a href="https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/minutes/rdp20190201.pdf">https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/minutes/rdp20190201.pdf</a>
29 March 2019	Subcommittee on Matters Relating to Railways	Administration's paper on incident of the new signalling system testing on Tsuen Wan Line on 18 March 2019	CB(4)687/18-19(03) <a href="https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20190329cb4-687-3-e.pdf">https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp20190329cb4-687-3-e.pdf</a>
		Letter from Hon Michael TIEN Puk-sun on issues relating to the collision incident of MTR trains during the testing of the new signalling system on Tsuen Wan Line on 18 March 2019 (Chinese version only)	CB(4)661/18-19(01) <a href="https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp20190329cb4-661-1-c.pdf">https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp20190329cb4-661-1-c.pdf</a>
		Joint letter from Dr Hon KWOK Ka-ki, Hon Jeremy TAM Man-ho, Hon Alvin YEUNG, Hon Tanya CHAN and Hon Dennis KWOK Wing-hang on issues relating to the collision incident of MTR trains during	CB(4)661/18-19(02) <a href="https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp20190329cb4-661-2-c.pdf">https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp20190329cb4-661-2-c.pdf</a>

Date of meeting	Meeting	Minutes/Paper	LC Paper No.
		<p>the testing of the new signalling system on Tsuen Wan Line on 18 March 2019 (Chinese version only)</p>	
		<p>Letter from Hon LUK Chung-hung on issues relating to the collision incident of MTR trains during the testing of the new signalling system on Tsuen Wan Line on 18 March 2019 (Chinese version only)</p>	<p>CB(4)661/18-19(03) <a href="https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp/b4-661-3-c.pdf">https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp/b4-661-3-c.pdf</a></p>
		<p>Letter from Hon Jeremy TAM Man-ho on MTR Automatic Train Protection system (Chinese version only)</p>	<p>CB(4)670/18-19(01) <a href="https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp/20190329cb4-670-1-c.pdf">https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp/20190329cb4-670-1-c.pdf</a></p>
		<p>Letter from Hon Charles Peter MOK on issues relating to the collision incident of MTR trains during the testing of the new signalling system on Tsuen Wan Line on 18 March 2019 (Chinese version only)</p>	<p>CB(4)683/18-19(01) <a href="https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp/20190329cb4-683-1-c.pdf">https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp/20190329cb4-683-1-c.pdf</a></p>
		<p>Minutes of meeting</p>	<p>CB(4)1245/18-19 <a href="https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/minutes/rdp20190329.pdf">https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/minutes/rdp20190329.pdf</a></p>

Date of meeting	Meeting	Minutes/Paper	LC Paper No.
6 December 2019	Subcommittee on Matters Relating to Railways	Information paper on the incident of the new signalling system testing on Tsuen Wan Line on 18 March 2019	CB(4)1097/18-19(01)  <a href="https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp/b4-1097-1-e.pdf">https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp/b4-1097-1-e.pdf</a>
		Joint letter dated 18 July 2019 from Hon Tanya CHAN and Hon Jeremy TAM Man-ho on the investigation result of the incident of MTR car crash (Chinese version only)	CB(4)1124/18-19(01)  <a href="https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp/b4-1124-1-c.pdf">https://www.legco.gov.hk/yr18-19/chinese/panels/tp/tp_rdp/papers/tp_rdp/b4-1124-1-c.pdf</a>
		Letter from Hon Jeremy TAM Man-ho on the collision incident of MTR trains during the testing of new signalling system on Tsuen Wan Line (English version only)	CB(4)940/18-19(01)  <a href="https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp/b4-940-1-e.pdf">https://www.legco.gov.hk/yr18-19/english/panels/tp/tp_rdp/papers/tp_rdp/b4-940-1-e.pdf</a>
5 May 2020	Subcommittee on Matters Relating to Railways	Administration's response to joint letter from Hon Tanya CHAN and Hon Jeremy TAM Man-ho on the investigation result of the incident of the new signalling system testing on Tsuen Wan Line as set out in LC Paper No. CB(4)1124/18-19(01)	CB(4)497/19-20(01)  <a href="https://www.legco.gov.hk/yr19-20/chinese/panels/tp/tp_rdp/papers/tp_rdp/b4-497-1-c.pdf">https://www.legco.gov.hk/yr19-20/chinese/panels/tp/tp_rdp/papers/tp_rdp/b4-497-1-c.pdf</a> (English version to follow)

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